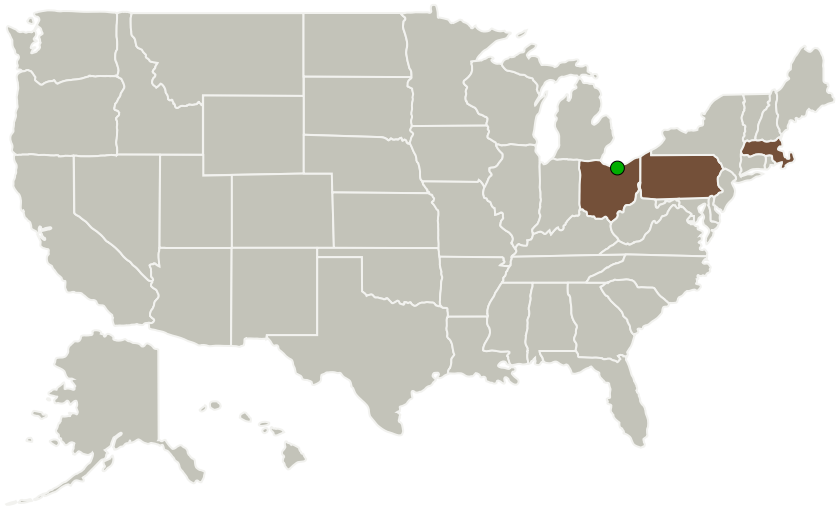
Magnesium Hall Thruster for Solar System Exploration, Phase I

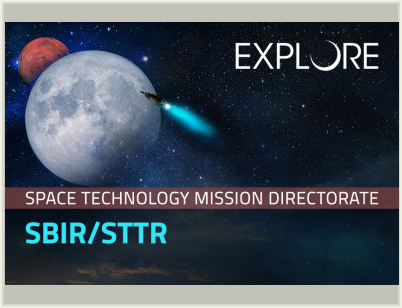
Completed Technology Project (2011 - 2012)

Project Introduction

Busek proposes to prove the feasibility of a Mg Hall effect thruster system that would open the door for In-Situ Resource Utilization (ISRU) based solar system exploration. Elemental magnesium has favorable thermophysical properties and is very easy to ionize. The estimated specific impulse for a high efficiency magnesium Hall thruster operating off of a standard 400 V power processing unit is 5000 s. Efficiencies >50% will be possible. Although the vapor pressure of Mg is relatively low, it is believed that spacecraft interactions can be managed through the implementation of a simple plume shield. Moreover, magnesium is found abundantly in the regolith of Mars and the Moon, from which it can be readily extracted. In Phase I, we will prove the concept's feasibility through four technical tasks. In the first task, the overall architecture of a Mg Hall thruster system will be established and subsystem requirements will be identified. In the second task, Busek will integrate an magnesium vapor propellant Hall thruster with a wire feed system. In the third task, the integrated system will be tested in Busek facilities. In the fourth task, the Applied Research Laboratory (ARL) at Penn State University will develop a powder feed system capable of fueling both medium and high power thrusters. A fully integrated system sized for NASA needs will be developed and characterized in Phase II.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Busek Company, Inc.	Lead Organization	Industry Women-Owned Small Business (WOSB)	Natick, Massachusetts
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Massachusetts	Ohio
Pennsylvania	

Project Transitions

February 2011: Project Start

February 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140243)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Busek Company, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

James Szabo

Co-Investigator:

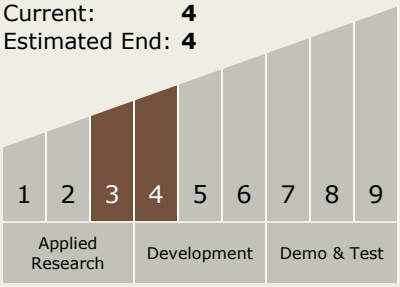
James Szabo

Magnesium Hall Thruster for Solar System Exploration, Phase I

Completed Technology Project (2011 - 2012)

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.2 Electrostatic

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System